

Water Quality Assessment Slate River Town of Crested Butte, Town of Crested Butte WWTF

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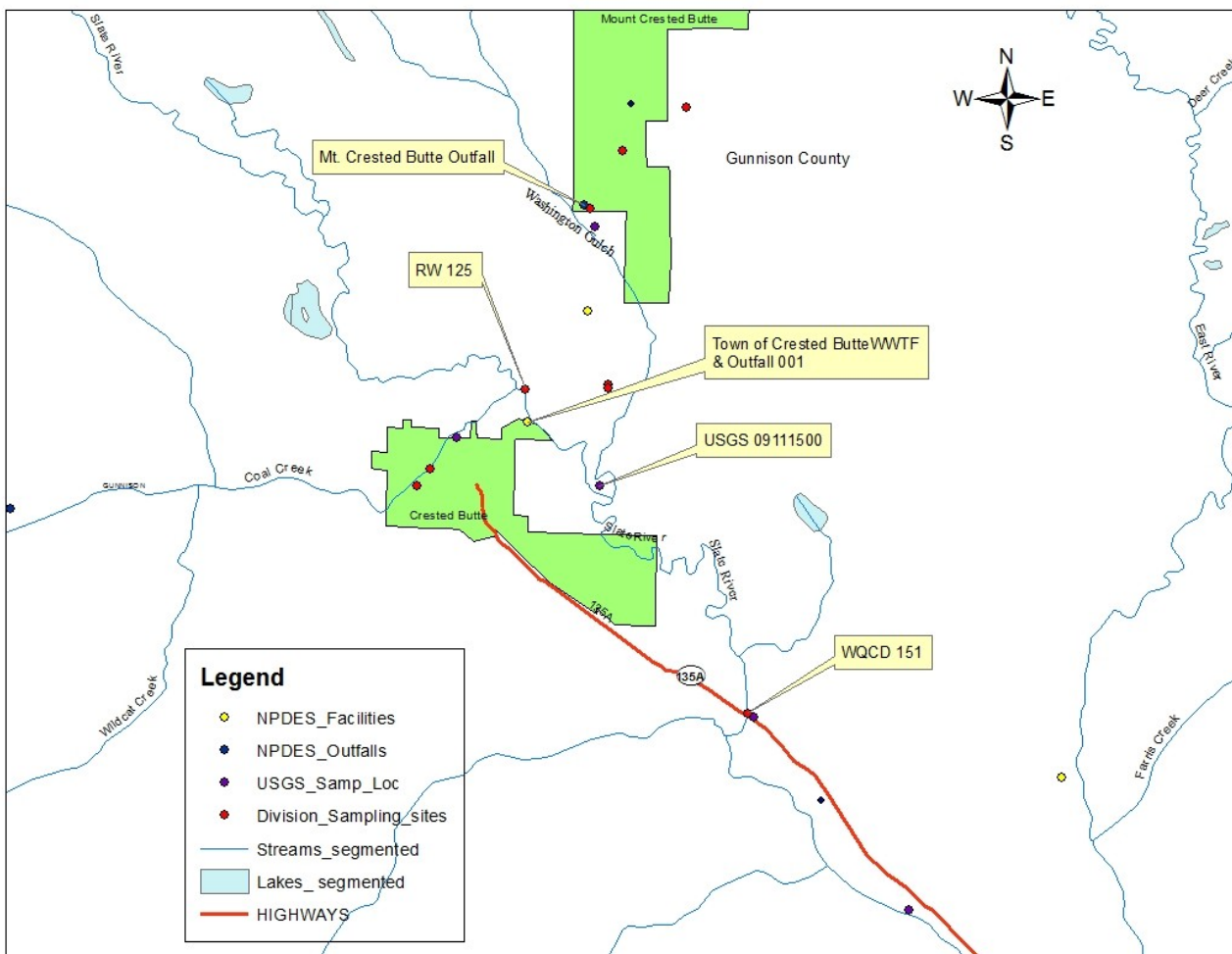
I. Water Quality Assessment Summary

Table A-1 includes summary information related to this WQA. This summary table includes key regulatory starting points used in development of the WQA such as: receiving stream information; threatened and endangered species; 303(d) and Monitoring and Evaluation listings; low flow and facility flow summaries; and a list of parameters evaluated.

Table A-1 WQA Summary					
Facility Information					
Facility Name		Permit Number	Design Flow (max 30-day ave, MGD)	Design Flow (max 30-day ave, CFS)	
Town of Crested Butte		CO0020443	0.6	0.93	
Receiving Stream Information					
Receiving Stream Name	Segment ID	Designation	Classification(s)		
Slate River	COGUUG08	Undesignated	Aquatic Life Cold 1 Recreation Class E Agriculture Water Supply		
Low Flows (cfs)					
1E3 (1-day)	7E3 (7-day)	30E3 (30-day)	Ratio of 30E3 to the Design Flow (cfs)		
4.2	4.9	9.4	10:1		
Regulatory Information					
T&E Species	303(d) (Reg 93)	Monitor and Eval (Reg 93)	Existing TMDL	Temporary Modification(s)	Control Regulation
No	Cd & Zn	Aquatic Life	No	None	None
Pollutants Evaluated					
Ammonia, <i>E. Coli</i> , TRC, pH, Temperature, Cd & Zn.					

II. Introduction

The water quality assessment (WQA) of Slate River near the Town of Crested Butte wastewater treatment facility (Crested Butte WWTF), located in Gunnison County, is intended to determine the assimilative capacities available for pollutants found to be of concern. This WQA describes how the water quality based effluent limits (WQBELs) are developed. These parameters may or may not appear in the permit with limitations or monitoring requirements, subject to other determinations such as reasonable potential analysis, evaluation of federal effluent limitation guidelines, implementation of state-based technology based limits, mixing zone analyses, 303(d) listings, threatened and endangered species listing, or other requirements as discussed in the permit factsheet. Figure A-1 contains a map of the study area evaluated as part of this WQA.

FIGURE A-1

The Town of Crested Butte WWTF discharges to Slate River, which is stream segment COGUUG08. This means the Gunnison and Lower Dolores River Basin, Upper Gunnison Sub-basin, Stream Segment 08. This segment is composed of the “Mainstem of the Slate River from a point immediately above the confluence with Coal Creek to the confluence with the East River.” Stream segment COGUUG08 is classified for Aquatic Life Cold 1, Recreation Class E, Water Supply and Agriculture.

This area of Colorado has been heavily mined in the past and the stream segment is currently listed in the Colorado’s 303(d) list of water quality impacted streams for cadmium and zinc.

Information used in this assessment includes data gathered from the Town of Crested Butte WWTF, the Division, the Colorado Division of Water Resources (DWR), Riverwatch, the U.S. Environmental Protection Agency (EPA), the U.S. Geological Survey (USGS) and communications with the local water commissioner. The data used in the assessment consist of the best information available at the time of preparation of this WQA analysis.

III. Water Quality Standards

Narrative Standards

Narrative Statewide Basic Standards have been developed in Section 31.11(1) of the regulations, and apply to any pollutant of concern, even where there is no numeric standard for that pollutant. Waters of the state shall be free from substances attributable to human-caused point source or nonpoint source discharges in amounts, concentrations or combinations which:

for all surface waters except wetlands;

(i) can settle to form bottom deposits detrimental to the beneficial uses. Depositions are stream bottom buildup of materials which include but are not limited to anaerobic sludge, mine slurry or tailings, silt, or mud; or (ii) form floating debris, scum, or other surface materials sufficient to harm existing beneficial uses; or (iii) produce color, odor, or other conditions in such a degree as to create a nuisance or harm existing beneficial uses or impart any undesirable taste to significant edible aquatic species or to the water; or (iv) are harmful to the beneficial uses or toxic to humans, animals, plants, or aquatic life; or (v) produce a predominance of undesirable aquatic life; or (vi) cause a film on the surface or produce a deposit on shorelines; and

for surface waters in wetlands;

(i) produce color, odor, changes in pH, or other conditions in such a degree as to create a nuisance or harm water quality dependent functions or impart any undesirable taste to significant edible aquatic species of the wetland; or (ii) are toxic to humans, animals, plants, or aquatic life of the wetland.

In order to protect the Basic Standards in waters of the state, effluent limitations and/or monitoring requirements for any parameter of concern could be put in CDPS discharge permits.

Standards for Organic Parameters and Radionuclides

Radionuclides: Statewide Basic Standards have been developed in Section 31.11(2) and (3) of The Basic Standards and Methodologies for Surface Water to protect the waters of the state from radionuclides and organic chemicals.

In no case shall radioactive materials in surface waters be increased by any cause attributable to municipal, industrial, or agricultural practices or discharges to as to exceed the following levels, unless alternative site-specific standards have been adopted. Standards for radionuclides are shown in Table A-2.

Table A-2 Radionuclide Standards	
Parameter	Picocuries per Liter
Americium 241*	0.15
Cesium 134	80
Plutonium 239, and 240*	0.15
Radium 226 and 228*	5
Strontium 90*	8
Thorium 230 and 232*	60
Tritium	20,000

*Radionuclide samples for these materials should be analyzed using unfiltered (total) samples. These Human Health based standards are 30-day average values for both plutonium and americium.

Organics: The organic pollutant standards contained in the Basic Standards for Organic Chemicals Table are applicable to all surface waters of the state for the corresponding use classifications, unless alternative site-specific standards have been adopted. These standards have been adopted as “interim standards” and will remain in effect until alternative permanent standards are adopted by the Commission. These interim standards shall not be considered final or permanent standards subject to antibacksliding or downgrading restrictions. Although not reproduced in this WQA, the specific standards for organic chemicals can be found in Regulation 31.11(3).

In order to protect the Basic Standards in waters of the state, effluent limitations and/or monitoring requirements for radionuclides, organics, or any other parameter of concern could be put in CDPS discharge permits.

The aquatic life standards for organics apply to all stream segments that are classified for aquatic life. The water supply standards apply only to those segments that are classified for water supply. The water + fish standards apply to those segments that have a Class 1 aquatic life and a water supply classification. The fish ingestion standards apply to Class 1 aquatic life segments that do not have a water supply designation. The water + fish and the fish ingestion standards may also apply to Class 2 aquatic life segments, where the Water Quality Control Commission has made such determination.

Because the Slate River is classified for Aquatic Life Cold 1, with a water supply designation, the water supply, water + fish, and aquatic life standards apply to this discharge.

Salinity

Regulation 61.8(2)(l) contains requirements regarding salinity for any discharges to the Colorado River Watershed. For industrial dischargers and for the discharge of intercepted groundwater, this is a no-salt discharge requirement. However, the regulation states that this requirement may be waived where the salt load reaching the mainstem of the Colorado River is less than 1 ton per day, or less than 350 tons per year. The Division may permit the discharge of salt upon a satisfactory demonstration that it is not practicable to prevent the discharge of all salt. See Regulation

61.8(2)(l)(i)(A)(1) for industrial discharges and 61.8(2)(l)(iii) for discharges of intercepted groundwater for more information regarding this demonstration.

For municipal dischargers, an incremental increase of 400 mg/l above the flow weighted averaged salinity of the intake water supply is allowed. This may be waived where the salt load reaching the mainstem of the Colorado River is less than 1 ton per day, or less than 366 tons per year. The Division may permit the discharge of salt in excess of the 400 mg/l incremental increase, upon a satisfactory demonstration that it is not practicable to attain this limit. See Regulation 61.8(2)(l)(vi)(A)(1) for more information regarding this demonstration.

In addition, the Division's policy, Implementing Narrative Standards in Discharge Permits for the Protection of Irrigated Crops, may be applied to discharges where an agricultural water intake exists downstream of a discharge point. Limitations for electrical conductivity and sodium absorption ratio may be applied in accordance with this policy.

Temperature

Temperature shall maintain a normal pattern of diurnal and seasonal fluctuations with no abrupt changes and shall have no increase in temperature of a magnitude, rate, and duration deemed deleterious to the resident aquatic life. This standard shall not be interpreted or applied in a manner inconsistent with section 25-8-104, C.R.S.

Segment Specific Numeric Standards

Numeric standards are developed on a basin-specific basis and are adopted for particular stream segments by the Water Quality Control Commission. The standards in Table A-3 have been assigned to stream segment COGUUG08 in accordance with the *Classifications and Numeric Standards for Gunnison and Lower Dolores River Basins*.

The Water Quality Control Commission has recently completed a preliminary final action concerning the *Classifications and Numeric Standards for Gunnison and Lower Dolores River Basins*. The proposed changes are not expected to impact this discharge with the exception of standards for temperature, specified in Table A-3 and discussed in Section VI of the WQA.

An amendment to the *Classifications and Numeric Standards for Gunnison and Lower Dolores River Basins* that becomes effective on March 30, 2013, will change the applicable standards for stream segment 35. This WQA has been developed in conformance with the water quality standards that will become effective on March 30, 2013, as any permitting action based on this WQA would take effect immediately after (or just prior to) the effective date of this regulation.

The Temporary modification for cadmium has been removed. Standards for temperature, dissolved trivalent chromium (chronic) and total recoverable molybdenum (chronic) have been included in this segment.

Table A-3
In-stream Standards for Stream Segment COGUUG08
Physical and Biological
Dissolved Oxygen (DO) = 6 mg/l, minimum
pH = 6.5 - 9 su
E. coli chronic = 126 colonies/100 ml
Temperature June-Sept = 17° C MWAT and 21.7° C DM
Temperature Oct-May = 9° C MWAT and 13° C DM
Inorganic
Total Ammonia acute and chronic = TVS
Chlorine acute = 0.019 mg/l
Chlorine chronic = 0.011 mg/l
Free Cyanide acute = 0.005 mg/l
Sulfide chronic = 0.002 mg/l
Boron chronic = 0.75 mg/l
Nitrite acute = 0.05 mg/l
Nitrate acute = 10 mg/l
Chloride chronic = 250 mg/l
Sulfate chronic = For WS, the greater of ambient water quality as of January 1, 2000 or 250 mg/l
Metals
Dissolved Arsenic acute = 340 µg/l
Total Recoverable Arsenic chronic = 0.02 µg/l
Dissolved Cadmium acute for trout and Dissolved Cadmium chronic = TVS
Total Recoverable Trivalent Chromium acute = 50 µg/l
Dissolved Trivalent Chromium chronic = TVS
Dissolved Hexavalent Chromium acute and chronic = TVS
Dissolved Copper acute and chronic = TVS
Dissolved Iron chronic = For WS, the greater of ambient water quality as of January 1, 2000, or 300 µg/l
Total Recoverable Iron chronic = 1000 µg/l
Dissolved Lead acute and chronic = TVS
Dissolved Manganese chronic = For WS, the greater of ambient water quality as of January 1, 2000, or 50 µg/l
Dissolved Manganese acute and chronic = TVS
Total Recoverable Molybdenum chronic = 160 µg/l
Total Mercury chronic = 0.01 µg/l
Dissolved Nickel acute and chronic = TVS
Dissolved Selenium acute and chronic = TVS
Dissolved Silver acute and Dissolved Silver chronic for trout = TVS
Dissolved Zinc acute and chronic = TVS

Statewide standards for total recoverable aluminum (acute/chronic) and nonylphenol (acute/chronic) may also be applied to this stream segment.

Table Value Standards and Hardness Calculations

Standards for metals are generally shown in the regulations as Table Value Standards (TVS), and these often must be derived from equations that depend on the receiving stream hardness or species of fish present; for ammonia, standards are discussed further in Section IV of this WQA. The Classification and Numeric Standards documents for each basin include a specification for appropriate hardness values to be used. Specifically, the regulations state that:

The hardness values used in calculating the appropriate metal standard should be based on the lower 95% confidence limit of the mean hardness value at the periodic low flow criteria as determined from a regression analysis of site-specific data. Where insufficient site-specific data exists to define the mean hardness value at the periodic low flow criteria, representative regional data shall be used to perform the regression analysis. Where a regression analysis is not appropriate, a site-specific method should be used.

Hardness data for Slate River near the point of discharge of the Town of Crested Butte WWTF were insufficient to conduct a regression analysis based on the low flow. Therefore, the Division's alternative approach to calculating hardness was used, which involves computing a mean hardness.

The mean hardness was computed to be 62 mg/l based on sampling data from USGS 09111500 (Slate River near Crested Butte) located on Slate River approximately 0.7 mile downstream from the Town of Crested Butte wastewater outfall. This hardness value and the formulas contained in the TVS were used to calculate the in-stream water quality standards for metals, with the results shown in Table A-4.

Table A-4 TVS-Based Metals Water Quality Standards for CO0020443 Based on the Table Value Standards Contained in the Colorado Department of Public Health and Environment Water Quality Control Commission <i>Regulation 35</i>			
<i>Parameter</i>	<i>In-Stream Water Quality Standard</i>		<i>TVS Formula:</i> <i>Hardness (mg/l) as CaCO₃ = 62</i>
Cadmium, Dissolved	Acute	1.1 µg/l	$[1.136672-0.041838\ln(\text{hardness})]e^{(0.9151(\ln(\text{hardness}))-3.6236)}$
	Chronic	0.3 µg/l	$[1.101672-0.041838\ln(\text{hardness})]e^{(0.7998(\ln(\text{hardness}))-4.4451)}$
Trivalent Chromium, Dissolved	Chronic	50 µg/l	$e^{(0.819(\ln(\text{hardness}))+0.5340)}$
Hexavalent Chromium, Dissolved	Acute	16 µg/l	Numeric standards provided, formula not applicable
	Chronic	11 µg/l	Numeric standards provided, formula not applicable
Copper, Dissolved	Acute	8.6 µg/l	$e^{(0.9422(\ln(\text{hardness}))-1.7408)}$
	Chronic	6 µg/l	$e^{(0.8545(\ln(\text{hardness}))-1.7428)}$
Lead, Dissolved	Acute	38 µg/l	$[1.46203-0.145712\ln(\text{hardness})][e^{(1.273(\ln(\text{hardness}))-1.46)}]$
	Chronic	1.5 µg/l	$[1.46203-0.145712\ln(\text{hardness})][e^{(1.273(\ln(\text{hardness}))-4.705)}]$
Manganese, Dissolved	Acute	2546 µg/l	$e^{(0.3331(\ln(\text{hardness}))+6.4676)}$
	Chronic	1407 µg/l	$e^{(0.3331(\ln(\text{hardness}))+5.8743)}$
Nickel, Dissolved	Acute	312 µg/l	$e^{(0.846(\ln(\text{hardness}))+2.253)}$
	Chronic	35 µg/l	$e^{(0.846(\ln(\text{hardness}))+0.0554)}$
Selenium, Dissolved	Acute	18.4 µg/l	Numeric standards provided, formula not applicable
	Chronic	4.6 µg/l	Numeric standards provided, formula not applicable
Silver, Dissolved	Acute	0.89 µg/l	$\frac{1}{2} e^{(1.72(\ln(\text{hardness}))-6.52)}$
	Chronic	0.033 µg/l	$e^{(1.72(\ln(\text{hardness}))-10.51)}$
Zinc, Dissolved	Acute	95 µg/l	$0.978e^{(0.8525(\ln(\text{hardness}))+1.0617)}$
	Chronic	83 µg/l	$0.986 e^{(0.8525(\ln(\text{hardness}))+0.9109)}$

Total Maximum Daily Loads and Regulation 93 – Colorado’s Section 303(d) List of Impaired Waters and Monitoring and Evaluation List

This stream segment is listed for monitoring and evaluation for aquatic life. According to Division standard procedure, the Division’s Environmental Data Unit investigates issues of water quality standard exceedances. If it is determined that the water body is impaired, the segment will be added to the 303(d) list. At a minimum, the permit may contain monitoring requirements to support a future TMDL if the segment is listed.

This stream segment is on the 303(d) list of water quality impacted streams for cadmium and zinc.

For a receiving water placed on this list, the Restoration and Protection Unit is tasked with developing the Total Maximum Daily Loads (TMDLs) and the Waste Load Allocation (WLAs) to be distributed to the affected facilities. WLAs for cadmium and zinc have not yet been established and the allowable concentration calculated in the following sections may change upon further evaluation by the Division.

IV. Receiving Stream Information

Low Flow Analysis

The Colorado Regulations specify the use of low flow conditions when establishing water quality based effluent limitations, specifically the acute and chronic low flows. The acute low flow, referred to as 1E3, represents the one-day low flow recurring in a three-year interval, and is used in developing limitations based on an acute standard. The 7-day average low flow, 7E3, represents the seven-day average low flow recurring in a 3 year interval, and is used in developing limitations based on a Maximum Weekly Average Temperature standard (MWAT). The chronic low flow, 30E3, represents the 30-day average low flow recurring in a three-year interval, and is used in developing limitations based on a chronic standard.

To best determine the low flows available at the point of discharge, a flow gage measurement immediately upstream of the WWTF should be used. Because there are no flow gages immediately upstream of the Town of Crested Butte WWTF, a downstream gage station, USGS 09111500 (Slate River near Crested Butte), located less than one mile downstream was used. Because the gage station is located downstream and daily flow data from the facility were not available, the average of the monthly average flow from the Crested Butte WWTF was deducted from the daily flows of respective months from the USGS flow data. The period of record (POR) was from January 1999 through October 2006. The annual 1E3, 7E3, and 30E3 low flows were calculated using U.S. Environmental Protection Agency (EPA) DFLOW software.

Based on the low flow analysis, the upstream low flows available to the Town of Crested Butte WWTF were calculated and are presented in Table A-5.

Table A-5													
Low Flows for Slate River at the Town of Crested Butte WWTF													
<i>Low Flow (cfs)</i>	<i>Annual</i>	<i>Jan</i>	<i>Feb</i>	<i>Mar</i>	<i>Apr</i>	<i>May</i>	<i>Jun</i>	<i>Jul</i>	<i>Aug</i>	<i>Sep</i>	<i>Oct</i>	<i>Nov</i>	<i>Dec</i>
1E3 Acute	4.2	7.5	7.5	9.4	17	53	16	7.2	4.2	4.2	11	12	8.4
7E3 Chronic	4.9	8.8	8.6	9.9	18	53	16	8.1	4.9	4.9	11	12	11
30E3 Chronic	9.4	9.5	9.5	9.9	18	53	16	9.4	9.4	9.4	11	12	11

During the months of May, June and October, the acute low flow calculated by DFLOW exceeded the chronic low flow. In accordance with Division standard procedures, the acute low flow was thus set equal to the chronic low flow for these months.

The ratio of the low flow of Slate River to the Town of Crested Butte WWTF design flow is 10:1.

Mixing Zones

The amount of the available assimilative capacity (dilution) that may be used by the permittee for the purposes of calculating the WQBELs may be limited in a permitting action based upon a mixing zone analysis or other factor. These other factors that may reduce the amount of assimilative capacity available in a permit are: presence of other dischargers in the vicinity; the presence of a water diversion downstream of the discharge (in the mixing zone); the need to provide a zone of passage for aquatic life; the likelihood of bioaccumulation of toxins in fish or wildlife; habitat considerations such as fish spawning or nursery areas; the presence of threatened and endangered species; potential for human exposure through drinking water or recreation; the possibility that aquatic life will be attracted to the effluent plume; the potential for adverse effects on groundwater; and the toxicity or persistence of the substance discharged.

Unless a facility has performed a mixing zone study during the course of the previous permit, and a decision has been made regarding the amount of the assimilative capacity that can be used by the facility, the Division assumes that the full assimilative capacity can be allocated. Note that the review of mixing study considerations, exemptions and perhaps performing a new mixing study (due to changes in low flow, change in facility design flow, channel geomorphology or other reason) is evaluated in every permit and permit renewal.

If a mixing zone study has been performed and a decision regarding the amount of available assimilative capacity has been made, the Division may calculate the water quality based effluent limitations (WQBELs) based on this available capacity. In addition, the amount of assimilative capacity may be reduced by T&E implications.

For this facility, 100% of the available assimilative capacity may be used as the results of the previous mixing zone study determine that the physical mixing zone is smaller than the regulatory mixing zone, and the discharge is not to a T&E stream segment, and is not expected to have an influence on any of the other factors listed above.

Ambient Water Quality

The Division evaluates ambient water quality based on a variety of statistical methods as prescribed in Section 31.8(2)(a)(i) and 31.8(2)(b)(i)(B) of the *Colorado Department of Public Health and Environment Water Quality Control Commission Regulation No. 31*, and as outlined in the Division's Policy for Characterizing Ambient Water Quality for Use in Determining Water Quality Standards Based Effluent Limits (WQP-19). Ambient water quality is evaluated in this WQA analysis for use in determining assimilative capacities and in completing antidegradation reviews for pollutants of concern, where applicable.

To conduct an assessment of the ambient water quality upstream of the Town of Crested Butte WWTF, data were gathered primarily from Riverwatch RW 125 (Slate River at Cemetery) located about 100 feet upstream of the outfall for pH, temperature, dissolved oxygen, cadmium and zinc. The POR was from 02/23/2001 to 06/01/2010. Ammonia data, POR from 05/29/2002 through 06/01/2010, were obtained from RW 125. Hardness and E coli data were obtained from USGS 09111500 POR from 05/02/2001 to 08/07/2012. Data from these sources were used to reflect upstream water quality. These data are summarized in Table A-6.

Table A-6 Ambient Water Quality for Slate River								
<i>Parameter</i>	<i>Number of Samples</i>	<i>15th Percentile</i>	<i>50th Percentile</i>	<i>85th Percentile</i>	<i>Mean</i>	<i>Maximum</i>	<i>Chronic Stream Standard</i>	<i>Notes</i>
Temp (°C)	71	0.5	4	14	6.3	22	NA	
DO (mg/l)	70	7.3	8.4	9.4	8.4	12	6	
pH (su)	72	7.4	7.7	8	7.7	8.4	6.5-9	
<i>E. coli</i> (#/100 ml)	20	2	7	60	9	130	126	1
NH ₃ as N, Tot (mg/l)	9	0	0	0.085	0.028	0.11	TVS	2
Cd, Dis (µg/l)	59	0.22	0.35	0.94	0.55	4.9	0.30	3
Zn, Dis (µg/l)	49	29	58	125	81	323	83	3
Hardness as CaCO ₃ (mg/l)	45	36	65	81	62	92	NA	
Note 1: The calculated mean is the geometric mean. Note that for summarization purposes, the value of one was used where there was no detectable amount because the geometric mean cannot be calculated using a value equal to zero.								
Note 2: When sample results were below detection levels, the value of zero was used in accordance with the Division's standard approach for summarization and averaging purposes.								
Note 3: The ambient water quality exceeds the water quality standards for these parameters.								

V. Facility Information and Pollutants Evaluated

Facility Information

The Town of Crested Butte WWTF is located in the S ½ of Section 35; Township 13 South; Range 86 West of the Sixth Principal Meridian; 800 Butte Avenue, Crested Butte, CO; at Latitude 38° 52' 29" N and the Longitude 106° 58' 33" W in Gunnison County. The current design capacity of the facility is 0.6 MGD (0.93 cfs). Wastewater treatment is accomplished using a mechanical wastewater treatment process. The technical analyses that follow include assessments of the assimilative capacity based on this design capacity.

An assessment of Division records indicate that there are no facilities with individual permits discharging to the same stream segment or other stream segments immediately upstream or downstream from this facility with the exception of the Town of Mt. Crested Butte WWTF, which discharges to Wood Creek. Other facilities discharging to the same stream segment or other stream segments immediately upstream or downstream from this facility are covered by general permits and

have limitations set at the water quality standards. These facilities were not modeled in this WQA as they have a minimal impact on the ambient water quality.

The Town of Mount Crested Butte WWTF (CO0027171) discharges into Wood Creek, which is in stream segment COGUUG13b. The discharge from Mount Crested Butte WWTF flows approximately 0.1 mile in Woods Creek to Washington Gulch, and flows approximately 1.5 miles from the confluence of Washington Gulch and Woods Creek to the Slate River. Due to the proximity of the discharge to the Slate River, the discharge from the Town of Crested Butte WWTF was modeled in conjunction with the discharge from Mount Crested Butte WWTF, in a previous WQA to ensure that the available assimilative capacities in the Slate River for total ammonia were not exceeded. It was concluded that the discharge from the Town of Crested Butte WWTF was found to have no impact on the ammonia assimilative capacities available to the Mount Crested Butte WWTF, and design flows have not increased since that time. Therefore, modeling the two facilities for total ammonia is not warranted at this time. The other pollutants of concern in common are cadmium and zinc (due to 303(d) listing for the Slate River) and *E. coli*. These were not modeled together due to distance (for *E. coli*) and potential permit limits at the water quality standard (for cadmium and zinc).

Note that due to the intermittent nature of stormwater discharges, and that these types of discharges do not typically occur at low flow conditions, they are not considered in this WQA.

Pollutants of Concern

Pollutants of concern may be determined by one or more of the following: facility type; effluent characteristics and chemistry; effluent water quality data; receiving water quality; presence of federal effluent limitation guidelines; or other information. Parameters evaluated in this WQA may or may not appear in a permit with limitations or monitoring requirements, subject to other determinations such as a reasonable potential analysis, mixing zone analyses, 303(d) listings, threatened and endangered species listings or other requirement as discussed in a permit rationale.

There are no site-specific in-stream water quality standards for BOD₅ or CBOD₅, TSS, percent removal, and oil and grease for this receiving stream. Thus, assimilative capacities were not determined for these parameters. The applicable limitations for these pollutants can be found in Regulation No. 62 and will be applied in the permit for the WWTF.

The following parameters were identified by the Division as pollutants to be evaluated for this facility:

- Total Residual Chlorine
- *E. coli*
- Ammonia
- Temperature
- pH
- Cadmium and zinc due to 303(d) listings

Based upon the size of the discharge, the lack of industrial contributors, dilution provided by the receiving stream and the fact that no unusually high metals concentrations are expected to be found

in the wastewater effluent, metals are not evaluated further in this water quality assessment, except for cadmium and zinc due to the 303(d) listing.

According to the *Rationale for Classifications, Standards and Designations of the Gunnison and Lower Dolores River*, stream segment COGUUG08 is designated a water supply because domestic water wells draw water from the alluvial aquifer which is hydrologically connected to the surface waters of this segment. Division record did not identify any wells on the alluvium downstream of the Crested Butte WWTF. For this reason, the nitrate standard, which is applied at the point of intake to a water supply, is not evaluated as part of this analysis.

During assessment of the facility, nearby facilities, and receiving stream water quality, no additional parameters were identified as pollutants of concern.

VI. Determination of Water Quality Based Effluent Limitations (WQBELs)

Technical Information

Note that the WQBELs developed in the following paragraphs, are calculations of what an effluent limitation may be in a permit. The WQBELs for any given parameter, will be compared to other potential limitations (Federal Effluent Limitations Guidelines, State Effluent Limitations, or other applicable limitation) and typically the more stringent limit is incorporated into a permit. If the WQBEL is the more stringent limitation, incorporation into a permit is dependent upon a reasonable potential analysis.

In-stream background data and low flows evaluated in Sections II and III are used to determine the assimilative capacity of Slate River near the Town of Crested Butte WWTF for pollutants of concern, and to calculate the WQBELs. For all parameters except ammonia, it is the Division's approach to calculate the WQBELs using the lowest of the monthly low flows (referred to as the annual low flow) as determined in the low flow analysis. For ammonia, it is the standard procedure of the Division to determine monthly WQBELs using the monthly low flows, as the regulations allow the use of seasonal flows.

The Division's standard analysis consists of steady-state, mass-balance calculations for most pollutants and modeling for pollutants such as ammonia. The mass-balance equation is used by the Division to calculate the WQBELs, and accounts for the upstream concentration of a pollutant at the existing quality, critical low flow (minimal dilution), effluent flow and the water quality standard. The mass-balance equation is expressed as:

$$M_2 = \frac{M_3 Q_3 - M_1 Q_1}{Q_2}$$

Where,

Q_1 = Upstream low flow (1E3 or 30E3)

Q_2 = Average daily effluent flow (design capacity)

Q_3 = Downstream flow ($Q_1 + Q_2$)

M_1 = In-stream background pollutant concentrations at the existing quality

M_2 = Calculated WQBEL

M_3 = Water Quality Standard, or other maximum allowable pollutant concentration

The upstream background pollutant concentrations used in the mass-balance equation will vary based on the regulatory definition of existing ambient water quality. For most pollutants, existing quality is determined to be the 85th percentile. For metals in the total or total recoverable form, existing quality is determined to be the 50th percentile. For pathogens such as fecal coliform and *E. coli*, existing quality is determined to be the geometric mean.

For temperature, the highest 7-day mean (for the chronic standard) of daily average stream temperature, over a seven consecutive day period will be used in calculations of the chronic temperature assimilative capacity, where the daily average temperature should be calculated from a minimum of three measurements spaced equally through the day. The highest 2-hour mean (for the acute standard) of stream temperature will be used in calculations of the acute temperature assimilative capacity. The highest 2-hour mean should be calculated from a minimum of 12 measurements spaced equally through the day.

Calculation of WQBELs

Using the mass-balance equation provided in the beginning of Section VI, the acute and chronic low flows set out in Section IV, ambient water quality as discussed in Section IV, and the in-stream standards shown in Section III, the WQBELs were calculated. The data used and the resulting WQBELs, M_2 , are set forth in Table A-7a for the chronic WQBELs and A-7b for the acute WQBELs.

When the ambient water quality exceeds the in-stream standard, as with cadmium and zinc, the Division standard procedure is to allocate the water quality standard to prevent further degradation of the receiving waters.

Chlorine: There are no point sources discharging total residual chlorine within one mile of the Town of Crested Butte WWTF. Because chlorine is rapidly oxidized, in-stream levels of residual chlorine are detected only for a short distance below a source. Ambient chlorine was therefore assumed to be zero.

E. coli: For *E. coli*, the Division establishes the 7-day geometric mean limit as two times the 30-day geometric mean limit and also includes maximum limits of 2,000 colonies per 100 ml (30-day geometric mean) and 4,000 colonies per 100 ml (7-day geometric mean). This 2000 colony limitation also applies to discharges to ditches.

Temperature:

A WQBEL for temperature can only be calculated if there is representative data, in the proper form, to determine what the background Maximum Weekly Average Temperature and Daily Maximum ambient temperatures are. As this data is not available at this time, the temperature limitation will be set at the water quality standard and will be revisited in the future when representative temperature data becomes available.

Table A-7a Chronic WQBELs							
<i>Parameter</i>	<i>Q₁ (cfs)</i>	<i>Q₂ (cfs)</i>	<i>Q₃ (cfs)</i>	<i>M₁</i>	<i>M₃</i>	<i>M₂</i>	<i>Notes</i>
Temp MWAT (°C) June-Sept	9.4	0.93	10.33	NA	17	17	
Temp MWAT (°C) Oct-May	9.4	0.93	10.33	NA	9	9	
E. coli (#/100 ml)	9.4	0.93	10.33	9	126	1305	
TRC (mg/l)	9.4	0.93	10.33	0	0.011	0.12	
Cd, Dis (µg/l)	9.4	0.93	10.33	0.94	0.3	0.3	1
Zn, Dis (µg/l)	9.4	0.93	10.33	125	83	83	1
Note 1: The existing water quality for this parameter exceeds the water quality standard; see the text for further discussion.							

Table A-7b Acute WQBELs							
<i>Parameter</i>	<i>Q₁ (cfs)</i>	<i>Q₂ (cfs)</i>	<i>Q₃ (cfs)</i>	<i>M₁</i>	<i>M₃</i>	<i>M₂</i>	<i>Notes</i>
Temp Daily Max (°C) June-Sept	4.2	0.93	5.13	NA	21.7	21.7	
Temp Daily Max (°C) Oct-May	4.2	0.93	5.13	NA	13.0	13	
TRC (mg/l)	4.2	0.93	5.13	0	0.019	0.1	
Cd, Dis (µg/l)	4.2	0.93	5.13	0.94	1.1	1.8	
Zn, Dis (µg/l)	4.2	0.93	5.13	125	95	95	1
Note 1: The existing water quality for this parameter exceeds the water quality standard; see the text for further discussion.							

Ammonia: The Ammonia Toxicity Model (AMMTOX) is a software program designed to project the downstream effects of ammonia and the ammonia assimilative capacities available to each discharger based on upstream water quality and effluent discharges. To develop data for the AMMTOX model, an in-stream water quality study should be conducted of the upstream receiving water conditions, particularly the pH and corresponding temperature, over a period of at least one year.

Temperature and corresponding pH data sets reflecting upstream ambient receiving water conditions were available from the Slate River at RW 125 (Slate River at Cemetery). The POR was from

02/23/2001 to 06/01/2010. The data were used to establish the setpoint and average headwater conditions in the AMMTOX model. Effluent pH data were also available from the Crested Butte facility and was used to establish the average facility contributions in the AMMTOX model.

There were no temperature data available from the Crested Butte facility that could be used as adequate input data for the AMMTOX model. Therefore, the Division standard procedure is to rely on statistically-based, regionalized data for temperature compiled from similar facilities.

Upstream ammonia data for each month were not adequate to represent monthly ambient water quality concentrations for the AMMTOX. Thus, the mean total ammonia concentration found in the Slate River at RW 125 as summarized in Table A-6 was used as an applicable upstream ammonia concentration reflective of each month.

The AMMTOX may be calibrated for a number of variables in addition to the data discussed above. The values used for the other variables in the model are listed below:

- Stream velocity = $0.3Q^{0.4d}$
- Default ammonia loss rate = 6/day
- pH amplitude was assumed to be medium
- Default times for pH maximum, temperature maximum, and time of day of occurrence
- pH rebound was set at the default value of 0.2 su per mile
- Temperature rebound was set at the default value of 0.7 degrees C per mile.

The results of the ammonia analyses for the Town of Crested Butte WWTF are presented in Table A-8.

Table A-8 AMMTOX Results for Slate River at the Town of Crested Butte WWTF		
<i>Design of 0.6 MGD (0.93 cfs)</i>		
<i>Month</i>	<i>Total Ammonia Chronic (mg/l)</i>	<i>Total Ammonia Acute (mg/l)</i>
January	29	40
February	27	35
March	32	35
April	49	57
May	156	222
June	54	86
July	39	74
August	41	90
September	51	95
October	39	60
November	35	55
December	30	37

VII. Antidegradation Evaluation

As set out in *The Basic Standards and Methodologies for Surface Water*, Section 31.8(2)(b), an antidegradation analysis is required except in cases where the receiving water is designated as “Use Protected.” Note that “Use Protected” waters are waters “that the Commission has determined do not warrant the special protection provided by the outstanding waters designation or the antidegradation review process” as set out in Section 31.8(2)(b). The antidegradation section of the regulation became effective in December 2000, and therefore antidegradation considerations are applicable to this WQA analysis.

According to the *Classifications and Numeric Standards for Gunnison and Lower Dolores River Basins*, stream segment COGUUG08 is Undesignated. Thus, an antidegradation review is required for this segment if new or increased impacts are found to occur.

Introduction to the Antidegradation Process

The antidegradation process conducted as part of this water quality assessment is designed to determine if an antidegradation review is necessary and if necessary, to complete the required calculations to determine the limits that can be selected as the antidegradation-based effluent limit (ADBEL), absent further analyses that must be conducted by the facility.

As outlined in the *Antidegradation Significance Determination for New or Increased Water Quality Impacts, Procedural Guidance* (AD Guidance), the first consideration of an antidegradation evaluation is to determine if new or increased impacts are expected to occur. This is determined by a comparison of the newly calculated WQBELs versus the existing permit limitations in place as of September 30, 2000, and is described in more detail in the analysis. Note that the AD Guidance refers to the permit limitations as of September 30, 2000 as the existing limits.

If a new or increased impact is found to occur, then the next step of the antidegradation process is to go through the significance determination tests. These tests include: 1) bioaccumulative toxic pollutant test; 2) temporary impacts test; 3) dilution test (100:1 dilution at low flow) and; 4) a concentration test.

As the determination of new or increased impacts, and the bioaccumulative and concentration significance determination tests require more extensive calculations, the Division will begin the antidegradation evaluation with the dilution and temporary impact significance determination tests. These two significance tests may exempt a facility from further AD review without the additional calculations.

Note that the antidegradation requirements outlined in *The Basic Standards and Methodologies for Surface Water* specify that chronic numeric standards should be used in the antidegradation review; however, where there is only an acute standard, the acute standard should be used. The appropriate standards are used in the following antidegradation analysis.

Significance Tests for Temporary Impacts and Dilution

This is not a temporary discharge and therefore exclusion based on a temporary discharge cannot be granted and the AD evaluation must continue.

The ratio of the chronic (30E3) low flow to the design flow is 10:1, and is less than the 100:1 significance criteria. Therefore this facility is not exempt from an AD evaluation based on the dilution significance determination test, and the AD evaluation must continue.

For the determination of a new or increased impact and for the remaining significance determination tests, additional calculations are necessary. Therefore, at this point in the antidegradation evaluation, the Division will go back to the new or increased impacts test. If there is a new or increased impact, the last two significance tests will be evaluated.

New or Increased Impact and Non Impact Limitations (NILs)

To determine if there is a new or increased impact to the receiving water, a comparison of the new WQBEL concentrations and loadings versus the concentrations and loadings as of September 30, 2000, needs to occur. If either the new concentration or loading is greater than the September 2000 concentration or loading, then a new or increased impact is determined. If this is a new facility (commencement of discharge after September 30, 2000) it is automatically considered a new or increased impact.

Note that the AD Guidance document includes a step in the New or Increased Impact Test that calculates the Non-Impact Limit (NIL). The permittee may choose to retain a NIL if certain conditions are met, and therefore the AD evaluation for that parameter would be complete. As the NIL is typically greater than the ADBAC, and is therefore the chosen limit, the Division will typically conclude the AD evaluation after determining the NIL. Where the NILs are very stringent, or upon request of a permittee, the Division will calculate both the NIL and the AD limitation so that the limitations can be compared and the permittee can determine which of the two limits they would prefer, one which does not allow any increased impact (NIL), or the other which allows an insignificant impact (AD limit).

The non impact limit (NIL) is defined as the limit which results in no increased water quality impact (no increase in load or limit over the September 2000 load or limit). The NIL is calculated as the September 2000 loading, divided by the new design flow, and divided by a conversion factor of 8.34. If there is no change in design flow, then the NIL is equal to the September 2000 permit limitation.

If the facility was in place, but did not have a limitation for a particular parameter in the September 2000 permit, the Division may substitute an implicit limitation. Consistent with the First Update to the AD Guidance of April 2002, an implicit limit is determined based on the approach that specifies that the implicit limit is the maximum concentration of the effluent from October 1998 to September 2000, if such data is available. If this data is unavailable, the Division may substitute more recent representative data, if appropriate, on a case by case basis. Note that if there is a change in design flow, the implicit limit/loading is subject to recalculation based on the new design flow. For parameters that are undisclosed by the permittee, and unknown to the Division to be present, an implicit limitation may not be recognized.

This facility was in place as a discharger prior to September 30, 2000, and therefore the new or increased impacts test must be conducted. As the design flow for this facility is the same as it was in September 2000, the NILs are equal to the permit limitations as of September 2000.

For total residual chlorine and total ammonia the limitations as of September 2000 were used in the evaluation of new or increased impacts.

For *E Coli*, data prior to 2000 were not available. Therefore data from 01/31/06 to 07/31/12 were determined to be adequate and were used to determine the implicit limitations.

For cadmium and zinc, there are no effluent data available and therefore, the Division will include monitoring requirements in the permit so that data can be collected in order to make such a determination of an implicit limit.

Calculation of Loadings for New or Increased Impact Test

The equations for the loading calculations are given below. Note that the AD requirements outlined in *The Basic Standards and Methodologies for Surface Water* specify that chronic numeric standards should be used in the AD review; however, where there is only an acute standard, the acute standard should be used. Thus, the chronic low flows will be used later in this AD evaluation for all parameters with a chronic standard, and the acute low flows will be used for those parameters with only an acute standard.

$$\begin{aligned} \text{Previous permit load} &= M_{\text{permitted}} (\text{mg/l}) \times Q_{\text{permitted}} (\text{mgd}) \times 8.34 \\ \text{New WQBELs load} &= M_2 (\text{mg/l}) \times Q_2 (\text{mgd}) \times 8.34 \end{aligned}$$

Where,

$M_{\text{permitted}}$	= September 2000 permit limit (or implicit limit) (mg/l)
$Q_{\text{permitted}}$	= design flow as of September 2000 (mgd)
Q_2	= current design flow (same as used in the WQBEL calculations)
M_2	= new WQBEL concentration (mg/l)
8.34	= unit conversion factor

Table A-9 shows the results of these calculations and the determination of a new or increased impact.

Table A-9 Determination of New or Increased Impacts						
<i>Pollutant</i>	<i>Sept 2000 Permit Limit</i>	<i>Sept 2000 Permit Load (lbs/day)</i>	<i>NIL</i>	<i>New WQBEL</i>	<i>New WQBEL Load (lbs/day)</i>	<i>New or Increased Impact</i>
E. coli (#/100 ml)	NA	NA	2690	1305	6530	No
TRC (mg/l)	0.039	0.2	0.039	0.12	0.6	Yes
NH ₃ , Tot (mg/l) Jan	34	170	34	29	145	No
NH ₃ , Tot (mg/l) Feb	32	160	32	27	135	No
NH ₃ , Tot (mg/l) Mar	28	140	28	32	160	Yes
NH ₃ , Tot (mg/l) Apr	32	160	32	49	245	Yes
NH ₃ , Tot (mg/l) May	91	455	91	156	781	Yes
NH ₃ , Tot (mg/l) Jun	316	1581	316	54	270	No
NH ₃ , Tot (mg/l) Jul	42	210	42	39	195	No
NH ₃ , Tot (mg/l) Aug	16	80	16	41	205	Yes
NH ₃ , Tot (mg/l) Sep	12	60	12	51	255	Yes
NH ₃ , Tot (mg/l) Oct	13	65	13	39	195	Yes
NH ₃ , Tot (mg/l) Nov	26	130	26	35	175	Yes
NH ₃ , Tot (mg/l) Dec	29	145	29	30	150	Yes
Cd, Dis (µg/l)	NA	NA	NA	0.3	0.0015	Yes
Zn, Dis (µg/l)	NA	NA	NA	83	0.42	Yes

As shown in Table A-9, there are no new or increased impacts to the receiving stream based on the new WQBELS for E Coli and ammonia for the months of January, February, June, and July. For these parameters the AD evaluation is complete and the WQBELs are the final result of this WQA.

For TRC, ammonia (March, April, May, August through December), cadmium and zinc, there are new or increased impacts and in accordance with regulation, the permittee has the option of choosing either the NIL's or ADBAC's. Because the ADBAC's are generally more stringent than NIL's, the Division assumes that the permittee will choose NIL's rather than ADBAC's, and therefore the Division will stop the AD evaluation at this point and assign the NILs to the permit. For those parameters where there is not a NIL (either implicit or explicit) the AD Guidance allows for the collection of data to determine an implicit limitation. Therefore, the permittee will be required to conduct "monitoring only" for those parameters. The permittee may request ADBAC limits. If the permittee does request ADBAC limits, the Division will proceed with the completion of this Antidegradation Analysis.

Alternatives Analysis

If the permittee does not want to accept an effluent limitation that results in no increased impact (NIL) or in insignificant degradation (ADBAC), the applicant may conduct an alternatives analysis (AA). The AA examines alternatives that may result in no degradation or less degradation, and are economically, environmentally, and technologically reasonable. If the proposed activity is

determined to be important economic or social development, a determination shall be made whether the degradation that would result from such regulated activity is necessary to accommodate that development. The result of an AA may be an alternate limitation between the ADBEL and the WQBEL, and therefore the ADBEL would not be applied. This option can be further explored with the Division. See Regulation 31.8 (3)(d), and the Antidegradation Guidance for more information regarding an alternatives analysis.

VIII. Technology Based Limitations

Federal Effluent Limitation Guidelines

The Federal Effluent Limitation Guidelines for domestic wastewater treatment facilities are the secondary treatment standards. These standards have been adopted into, and are applied out of, Regulation 62, the Regulations for Effluent Limitations.

Regulations for Effluent Limitations

Regulation No. 62, the Regulations for Effluent Limitations, includes effluent limitations that apply to all discharges of wastewater to State waters, with the exception of storm water and agricultural return flows. These regulations are applicable to the discharge from the proposed discharge.

Table A-10 contains a summary of the applicable limitations for pollutants of concern at this facility.

Table A-10			
Regulation 62 Based Limitations			
Parameter	30-Day Average	7-Day Average	Instantaneous Maximum
BOD ₅	30 mg/l	45 mg/l	NA
BOD ₅ Percent Removal	85%	NA	NA
TSS, mechanical plant	30 mg/l	45 mg/l	NA
TSS Percent Removal	85%	NA	NA
Total Residual Chlorine	NA	NA	0.5 mg/l
pH	NA	NA	6.0-9.0 s.u.
Oil and Grease	NA	NA	10 mg/l

IX. References

Regulations:

The Basic Standards and Methodologies for Surface Water, Regulation 31, Colorado Department Public Health and Environment, Water Quality Control Commission, effective January 31, 2013.

Classifications and Numeric Standards for Gunnison and Lower Dolores River Basins, Regulation No. 35, Colorado Department Public Health and Environment, Water Quality Control Commission, effective March 30, 2013.

Regulations for Effluent Limitations, Regulation 62, CDPHE, WQCC, March 30, 2008.

Colorado's Section 303(d) List of Impaired Waters and Monitoring and Evaluation List, Regulation 93, Colorado Department Public Health and Environment, Water Quality Control Commission, effective April 30, 2010.

Policy and Guidance Documents:

Antidegradation Significance Determination for New or Increased Water Quality Impacts, Procedural Guidance, Colorado Department Public Health and Environment, Water Quality Control Division, December 2001.

Memorandum Re: First Update to (Antidegradation) Guidance Version 1.0, Colorado Department Public Health and Environment, Water Quality Control Division, April 23, 2002.

Rationale for Classifications, Standards and Designations of Segments of the Gunnison and Lower Dolores River, Colorado Department Public Health and Environment, Water Quality Control Division, effective March 30, 2013.

Policy Concerning Escherichia coli versus Fecal Coliform, CDPHE, WQCD, July 20, 2005.

Colorado Mixing Zone Implementation Guidance, Colorado Department Public Health and Environment, Water Quality Control Division, effective April 2002.

Policy for Conducting Assessments for Implementation of Temperature Standards in Discharge Permits, Colorado Department Public Health and Environment, Water Quality Control Division Policy Number WQP-23, effective July 3, 2008.

Implementing Narrative Standards in Discharge Permits for the Protection of Irrigated Crops, Colorado Department Public Health and Environment, Water Quality Control Division Policy Number WQP-24, effective March 10, 2008.

Policy for Characterizing Ambient Water Quality for Use in Determining Water Quality Standards Based Effluent Limits, Colorado Department Public Health and Environment, Water Quality Control Division Policy Number WQP-19, effective May 2002.